Resource Adequacy and Rolling Blackouts

RA Evolution and R&D

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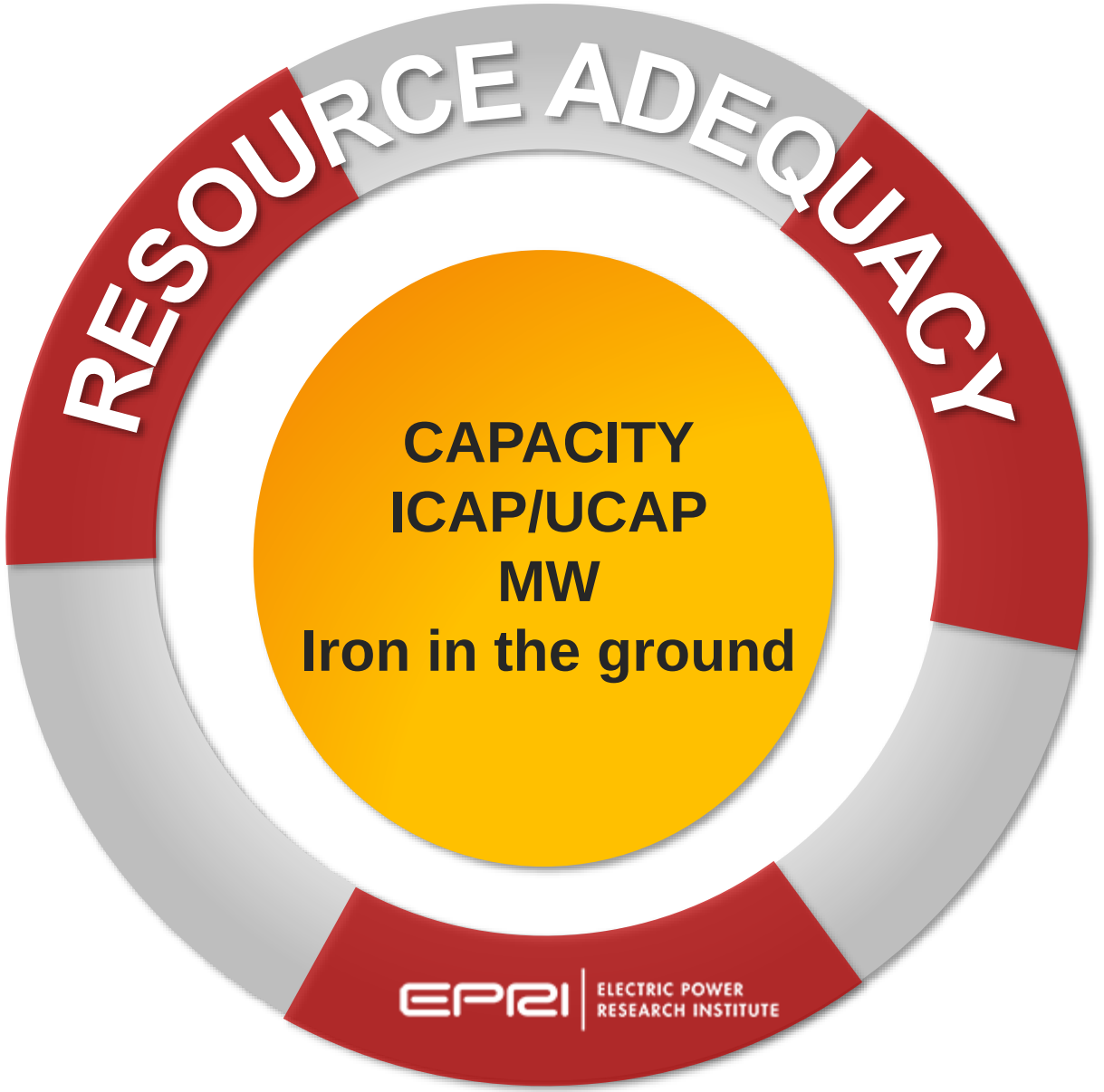
ESIG Spring Webcasts
April 2021

What does it mean to have adequate resources?



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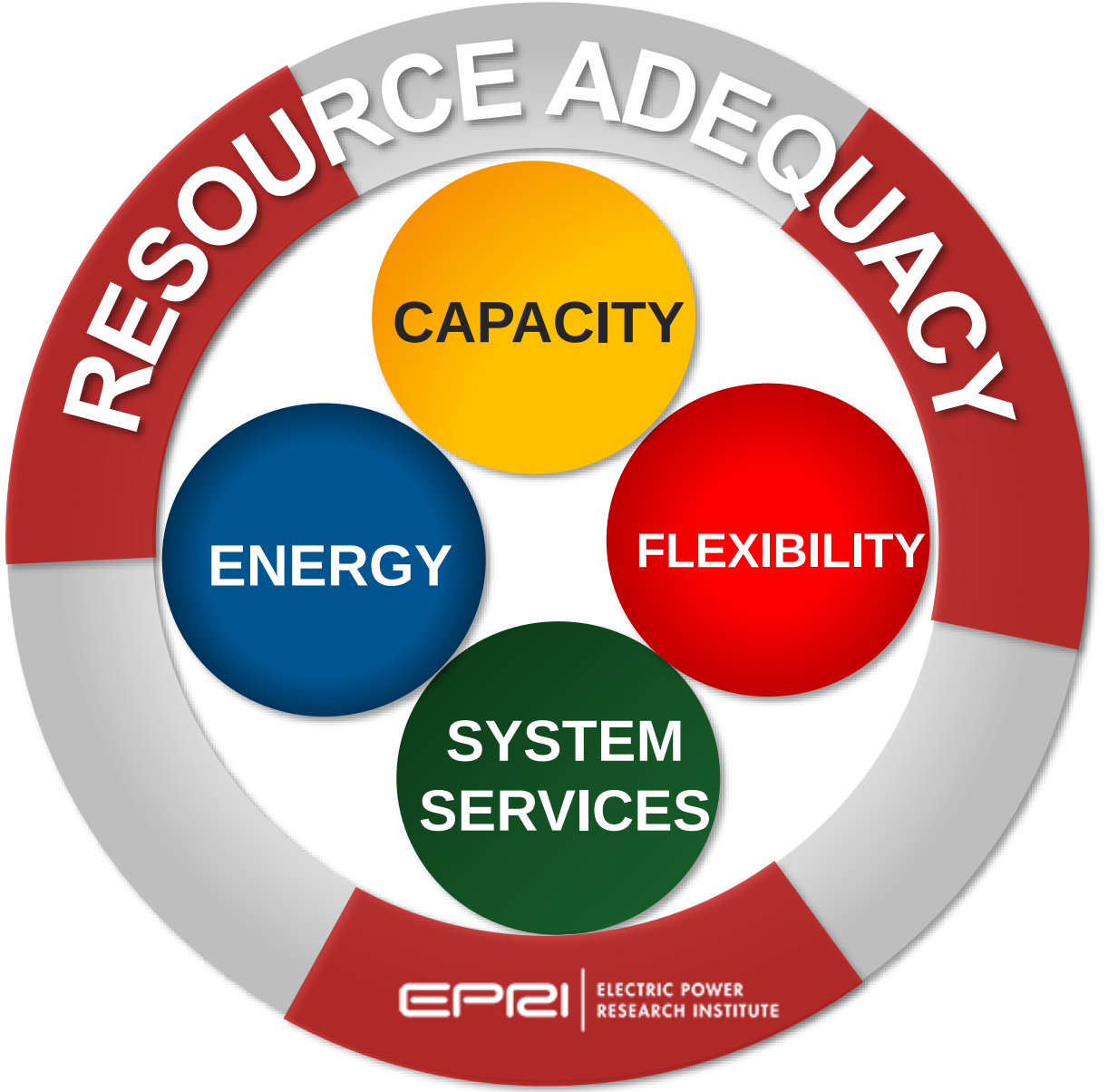


An adequate supply fleet is not just the installed MW in the ground. The capacity must have energy to sustain during critical time periods, flexibility to accommodate condition changes, and sufficient reliability services to provide when necessary

Feb. 2021 Polar Vortex: RA Improvements Indicated

Historic Winter Peak Demand

- 10 GW (13%) > prior winter peak
- 10% > extreme winter plan level

Unprecedented Supply Outages

- ≈50% of supply capacity unavailable
- Equipment and fuel supply limits
- Common-mode failures across systems

Load Shed to Prevent Blackout

- ERCOT shed an estimated 800 GWh (27 GW peak)
- SPP, MISO, and Cenace also shed load

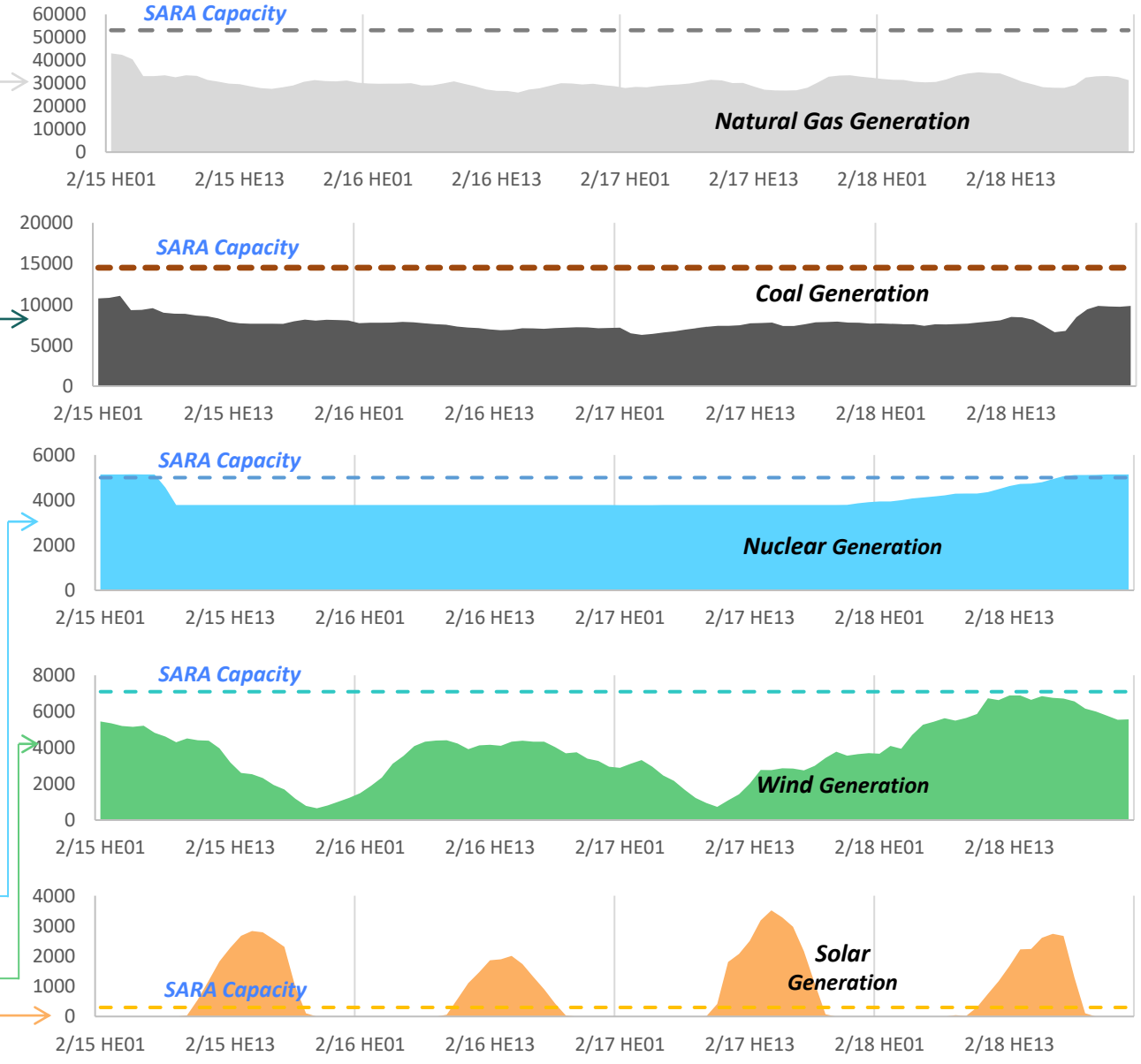
- Scenario planning includes future trends (climate, etc.)
- Metrics reflect magnitude and duration of events
- Design criteria reflect future system consequences
- Resource performance in future context considered
- Impacts of common mode and interdependent impacts considered

RA assessment methods and tools must evolve to ensure resiliency.

ERCOT Electricity Generation vs. Seasonal Expected Availability

Feb. 15-18

2021 Winter SARA	Seasonal Assessment of Resource Adequacy* (SARA) vs. Actual Generation	Performance vs. SARA
Natural Gas: 55,663 MW (66%)	SARA Capacity; Natural Gas Generation	55%
Coal: 13,630 MW (16%)	SARA Capacity; Coal Generation	58%
Nuclear: 5,153 MW (6%)	SARA Capacity; Nuclear Generation	79%
Wind: 7,100 MW (8%)	SARA Capacity; Wind Generation	57%
Solar: 300 MW (0%)	SARA Capacity; Solar Generation	54%†



** ERCOT's Seasonal Assessment of Resource Adequacy (SARA) attributes an expected available capacity to each generation type, considering seasonal factors.*

Data Sources:
Winter '21 SARA
Daily Balancing Authority Report

†During peak demand (18-23h)
Over all hours: 259%

Projecting event probabilities

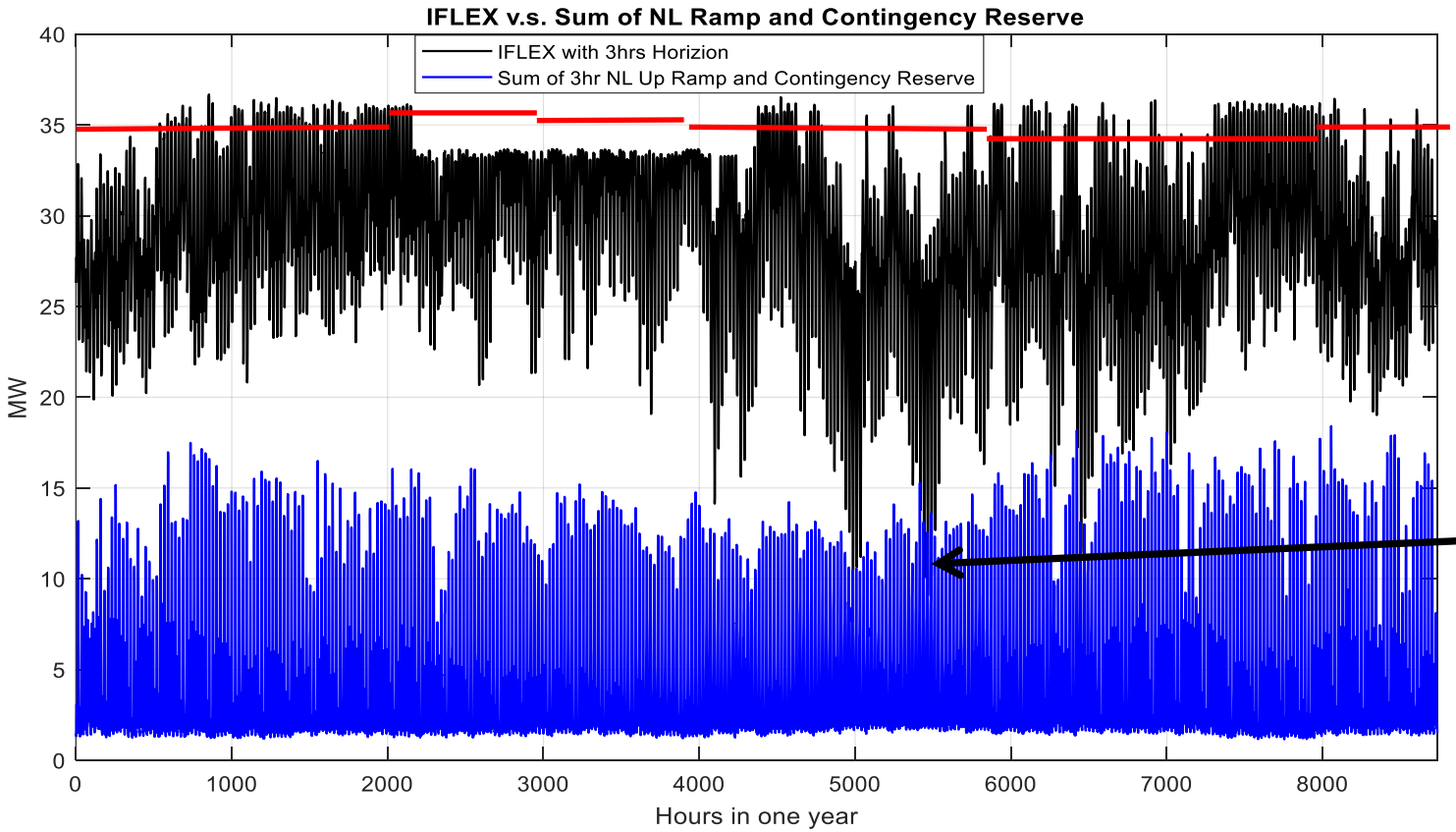
- Climate change is resulting in more frequent extreme weather events
- Historical probabilities do not capture these extremes, making forecasting or projecting future disruptive events difficult

Type of Extreme Weather	Frequency	Intensity	Geographic Extent
Extreme Heat Events	↑	↑	↑
Drought	↑	↑	↑
Wildfires	↑	↑	↑
Extreme Precipitation/ Flooding	↑	↑	↑
Hurricanes/ Tropical Storms	↔	↑	↑
Cold Events	↑	↓	
Heavy Snow Events	↔	↔	
Severe Weather (e.g., tornados, hail)	↔	↔	

Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy, 2020 (Product ID 3002019300)
https://www.epri.com/research/products/000000003002019300

The historical probabilities of weather events need to be adjusted to take climate trends into account

Operations may affect resource adequacy



EFC

IFLEX <25% EFC

Flexibility Assessment for the California ISO, EPRI, Palo Alto: 3002013725, 2019. https://www.epri.com/research/products/000000003002013725

The amount of "feasible installed flexibility" can be far less than the apparent installed flexibility.

Market design and clearing software

- Market clearing software “tests” for extreme conditions
- Would capacity market have made a difference? A “winterization product”?
- Who decides RA contribution (counting) for different resources and technologies?
- What should consumers pay during excessive outages?

ERCOT Software:

- AS prices of $27,000/MW-h
- LMP of $1,000/MWh when massive load shed present
- ORDC Adder

After reviewing the perfomance of the day-ahead market for August 14, the CAISO determined that a market enhancement that was made to the RUC process in prior years was masking the effects of load under-scheduling and convergence bidding. This enhancement provides necessary functionality for other market processes, but in the RUC process it erroneously signaled that more exports were physically supportable than actually were.